

Claims

1. A method for training a neural network to
5 determine risk functions for patients following a first
occurrence of a predetermined disease on the basis of
given training data records containing objectifiable and
metrologically captured data relating to the medical
condition of the patient, wherein the neural network
10 comprises:
- an input layer having a plurality of input neurons,
 - at least one intermediate layer having a plurality
of intermediate neurons,
 - an output layer having a plurality of output
15 neurons, and
 - a multiplicity of synapses which interconnect two
neurons of different layers in each case,
- characterized in that the training of the neural network
comprises a structure simplification procedure, that is
20 to say the location and elimination of synapses that have
no significant influence on the curve of the risk
function, in that
- a1) one selects two sending neurons that are connected
to one and the same receiving neuron,
 - 25 a2) one assumes that the signals output from said
sending neurons to the receiving neuron essentially
exhibit the same qualitative behavior, that is to
say are correlated to one another,
 - a3) one interrupts the synapse of one of the two sending
30 neurons to the receiving neuron and instead adapts
accordingly the weight of the synapse of the
respective other sending neuron to the receiving
neuron,
 - a4) one compares the reaction of the neural network
35 changed in accordance with step a3) with the
reaction of the unchanged neural network, and

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a5) if the variation of the reaction does not exceed a predetermined level, one decides to keep the change made in step a3).

2. The method as claimed in claim 1, characterized in that the two sending neurons are located on one and the same layer.

3. The method as claimed in claim 1 or 2, characterized in that furthermore the value of the bias of the receiving neuron is adapted in step a3).

4. A method for training a neural network in accordance with the preamble of claim 1 and if desired with the characterizing parts of any of claims 1 to 3, characterized in that the training of the neural network comprises a structure simplification procedure, that is to say the location and elimination of synapses that have no significant influence on the curve of the risk function, in that

b1) one selects a synapse,

b2) one assumes that said synapse does not have a significant influence on the curve of the risk function,

b3) one interrupts said synapse,

b4) one compares the reaction of the neural network changed in accordance with step b3) with the reaction of the unchanged neural network, and

b5) if the variation of the reaction does not exceed a predetermined level, one decides to keep the change made in step b3).

5. The method as claimed in claim 4, characterized in that, when in the course of the structure simplification procedure n-1 synapses have already been eliminated and the strength of the influence of an nth synapse is being tested, the reaction of the neural network reduced by n synapses is not only compared with the reaction of a network reduced by only n-1 synapses, but also with the reaction of the neural network with its complete structure as present at the beginning of said structure simplification procedure, and in that the

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elimination of the nth synapse is only retained if the deviation of the reaction does not exceed a predetermined level for both comparisons.

- Sub A2
- 5 6. The method as claimed in any of claims 1 to 5, characterized in that the value of a likelihood function is calculated for the neural network to represent the reaction of the neural network.
- 10 7. The method as claimed in any of claims 1 to 6, characterized in that the structure variants of the neural network are compared using a significance test.
8. The method as claimed in claim 7, characterized in that the structure variants of the neural network are compared using the CHI-SQUARED test which is known per se.
- 15 9. The method as claimed in claim 7, characterized in that the structure variants of the neural network are compared using the BOOT-STRAPPING method which is known per se.
- 20 10. The method as claimed in any of claims 1 to 8, characterized in that, to compare two structure variants of the neural network, the ratio of the values of the likelihood functions for said two structure variants is calculated.
- 25 11. A method for training a neural network in accordance with the preamble of claim 1 and if desired with the characterizing parts of any of claims 1 to 10, characterized in that the training of the neural network comprises an optimization procedure in which the strengths of the individual synapses, that is to say the
- 30 strengths of the connections between the neurons, are optimized, and in that the simplex method which is known per se is used for said optimization.
- Sub A3

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